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1974 J. Phys. A: Math. Nucl. Gen. 7 L25

(http://iopscience.iop.org/0301-0015/7/2/020)

J. Phys. A: Math., Nucl. Gen., Vol. 7, No. 2, 1974. Printed in Great Britain. © 1974

LETTER TO THE EDITOR

The matrix representation of the operators acting in the Radcliffe space

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Received 30 July 1973, in final form 12 November 1973

Abstract. The rule for constructing the matrix representation of operators expressed as functions of (S_+, S_-, S_z) is given.

We deal with the functions

$$\|\mu\rangle = (1+|\mu|^2)^S|\mu\rangle = \sum_{p=0}^{2S}\binom{2S}{p}^{1/2}\mu^p|p\rangle, \tag{1}$$

where $|\mu\rangle$ are the Radcliffe functions determining the spin coherent states. Let us choose any arbitrary set of complex numbers $\mu_0, \mu_1, \ldots, \mu_{2S}$ which satisfy the only restriction

$$\Delta = \begin{vmatrix} 1 & \mu_0 & {\mu_0}^2 & \cdots & {\mu_0}^{2S} \\ 1 & \mu_1 & {\mu_1}^2 & \cdots & {\mu_1}^{2S} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 1 & \mu_{2S} & {\mu_{2S}}^2 & \cdots & {\mu_{2S}}^{2S} \end{vmatrix} \neq 0. \tag{2}$$

We can substitute the new basis $\|\mu_0\rangle, \|\mu_1\rangle, \ldots, \|\mu_{2S}\rangle$ for the basis $|p\rangle$ in formula (1). As a consequence, the functions $\|\mu\rangle$ assume the form

$$\|\mu\rangle = \frac{1}{\Delta}\sum_{p=0}^{2S}\sum_{t=0}^{2S}\mu^p M_{tp}\|\mu_t\rangle, \tag{3}$$

where M_{tp} is a subdeterminant.

The matrix element related to any operator $\hat{\mathscr{G}}$ assumes the form

$$\langle\lambda\|\hat{\mathscr{G}}\|\mu\rangle = \sum_{p,q}^{2S}(\lambda^*)^q\mu^p A_{qp}, \tag{4}$$

where

$$A_{qp} = \frac{1}{|\Delta|^2}\sum_{jt}^{2S} {M_{jq}}^*\langle\mu_j\|\hat{\mathscr{G}}\|\mu_t\rangle M_{tp}$$

must be independent of any basis. The matrices A_{qp} may be recognized as the relevent operator representation.

It is easy to verify that this matrix representation obeys the following algebra:

$$ {A_{qp}}^{12} = \sum_r^{2S}\frac{{A_{qr}}^1{A_{rp}}^2}{\binom{2S}{r}}, \tag{5}$$

where ${A_{qp}}^{12}$ is related to

$$\hat{\mathscr{G}}^{12} = \hat{\mathscr{G}}^1 . \hat{\mathscr{G}}^2.$$